FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

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Founder and Editor: STANLEY SPOONER
A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport
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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

1922.	
Feb. 23	**Lecture, "Some possible Improvements in Aero Engine Installation," by G. R. Irvine, before Students' Section R.Ae.S.**
Mar. 2	**Lecture, "Testing Aircraft to Destruction," by W. D. Douglas, before R.Ae.S.**
Mar. 16	**Lecture, "Radiological Research," by Dr. V. E. Pullin, before R.Ae.S.**
Mar. 26–April 2	**Nice Meeting**
Mar. 30	**Lecture, "The Design of a Commercial Aeroplane," by Capt. de Havilland, before R.Ae.S.**
April 17	**R.Ae.C. Race Meeting, at Waddon**
June 5	**R.Ae.C. Race Meeting, at Waddon**
July 6–20	**French Gliding Competition**
Aug. 6	**Gordon-Bennett Balloon Race, Geneva**
Aug. 7	**R.Ae.C. Race Meeting, at Waddon**
Aug. (last fortnight)	**Schneider Cup Seaplane Race, at Naples**
Sept.	**Tyrrhenian Cup, Italy**
Sept.	**Italian Grand Prix**
Sept. or Oct.	**R.Ae.C. Race Meeting, at Waddon**
Sept. 22 ...	**Coupe Deutsche (300 kil.)**

EDITORIAL COMMENT

IN this issue of FLIGHT we publish *résumés* of two technical papers read before the Air Conference during the afternoon session of the second day. The first is by Major F. M. Green, and deals with research from the designer's, constructor's and user's points of view. The second is by the Director of Research, Brig.-Gen. R. K. Bagnall-Wild, and gives a summary of the progress made in research since the last Air Conference. A third paper, by Major Scott, has, unfortunately, had to be held over until next week owing to lack of space. It has for its subject "Airships," and gives a brief outline of the position of airships today the world over. All three papers are of the greatest interest, and we should have liked to be able to publish them in full. That, however, has been found impossible, but it is hoped that in the extracts and *résumés* published elsewhere in this issue no points of primary importance have been omitted.

Technical Papers at the Air Conference

Taking the first two papers, it seems to us that Major Green was a little too pessimistic as regards the value to the designer of scale model tests in the wind channels. It is true that a scale effect exists, sometimes it may be of considerable magnitude, and on occasion it has been known to "go the wrong way," but generally speaking, a fair estimate can be made from model figures. What does the difference amount to after all is said and done? As Professor Bairstow pointed out, we no longer need wonder whether a machine will fly or not, and, if the actual performance attained differs from the estimated performance based on model figures by as much as 10 m.p.h., we are frankly surprised. Is it, therefore, quite fair to cast doubt upon the value of research data to designers of machines? We do not think it is. If Major Green had confined himself to stating that the scale effect exists, that at present its magnitude is somewhat uncertain, and that further research is wanted to settle definitely this question in such a manner that the designer can apply the avilable data direct, then we should have been quite with him. But in the face of all that the N.P.L. and others have done we think it

is a little unkind to give the impression that the results are open to grave doubts. That they need to be used with a certain amount of discretion may be admitted, but the majority of designers at work to-day have had sufficient experience to enable them to use their discretion sufficiently to ensure that no machine is built which falls very far short of the estimated figures.

With regard to the question of stability, we think that here is a field for legitimate research, and one which should be explored vigorously at all costs. The problems of longitudinal stability are fairly well understood, but lateral stability and control at angles near the critical angle are still problems which require research. The value of being able to decide the problems is so great that whatever the cost the necessary funds should be provided.

Another item which, as the Director of Research pointed out, is one of the very greatest importance, is that of the aero engine. If, at one stroke, it were possible to produce an engine with 100 per cent. reliability, many, indeed most, of our troubles would be over. Night flying and flying in fog and clouds would present but few difficulties then, and if, coupled with such reliability, our ideal engines were at the same time more economical in fuel, safer from fire risk, and not very much heavier, we should be on the threshold of the new era of commercial aviation. By this we do not mean that civil aviation cannot attain commercial success with the present engines. We firmly believe that it can, but our ideal engine would bring that day very much nearer.

It appears to be fairly generally agreed among engine experts that the petrol engine has reached, for all practical purposes, the limits of its development as regards thermodynamic efficiency. If another 10 per cent. efficiency can be attained that is about all that can be expected, even theoretically. As Mr. Alan Chorlton pointed out, if we are to have any hopes of great improvement, we must attack the problem metallurgically rather than thermodynamically. There is as yet no means of estimating by how much the weight of an engine could be reduced by the use of lighter metals. Here then is a field for research which gives fair promise of important results. And it is not as if the discovery or invention of new metals were of use to the engine maker only. For each new metal, as its properties become known, new uses are constantly being found. So also in this case. While the immediate object might be steel or other alloys for aero engines, the production of such alloys would in all probability be hailed with satisfaction by aircraft makers also, to mention only one field which would profit by research not undertaken primarily on its own account.

The Diesel, or direct injection, engine as applied to aircraft is a problem which is being attacked all over the world, and here it appears that the best procedure is, as suggested by Professor Burstall, to carry out research on methods of injection and similar problems rather than to attempt to run before we have learned to walk, by building complete engines. In this field also, incidentally, the production of new and lighter metals would be of at least as great benefit as it would to engines of the present type, so that when the day comes, as assuredly it will, when we can produce direct-injection engines, the new metals would help materially in making them applicable to aircraft.

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Standardising Airship Moorings, etc.

Elsewhere in this issue of FLIGHT will be found a report of the International Conference called, we believe, mainly on the initiative of that indefatigable worker for the cause of airships, Mr. Ashbolt, Agent-General for Tasmania, and Commander Boothby, R.N., to discuss the possibility of standardising, or at any rate agreeing upon, certain lines upon which to work the mooring, fuelling and gassing arrangements for airships. Representatives of a number of countries were present at the conference, and much good work was done, and certain recommendations made. If it is true that aircraft development will be largely international in character, then it is the more so as regards airships, which are primarily intended for long-distance, and therefore international, flying. At the present time, when no country is doing a great deal with commercial airships, it is not a very difficult matter to lay down certain rules and regulations for such details, whereas in a few years' time, when several countries have got started with their own particular arrangements, it would be much more difficult to get these altered than if certain arrangements had been agreed upon from the start. We therefore welcome this conference, and feel certain that it cannot fail to do a great deal of good, which will be appreciated, possibly, more in a few years' time than it can be at the present moment.

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The 1,000 h.p. Napier

When the first 1,000 H.P. Napier "Cub" made its appearance just about one year ago, the fact was hailed with general satisfaction by reason of this country being the first to produce a really first-class single unit of this power. The second engine, incorporating certain improvements suggested by experience gained with the experimental engine, is now completed, and no time is being lost in installing it into a special aeroplane. As this 'plane is built for, and is the property of, the Air Ministry, nothing may be said about it, nor about the purpose for which it is intended. We have seen the machine and we have seen the engine (which is dealt with elsewhere this week), but not, it is true, in place in the machine, and we feel confident that the *ensemble* represents a combination which a good many nations would pay a great deal to possess. We must leave it at that, and hope that it may be found possible to spare one or two "Cubs" for experimenting with commercial machines with single engines of this power. No doubt the demand from the Air Force will be great, but the possibilities of the commercial utilisation of an engine of such power are equally great, and the existence of the "Cub" should open up a new field in commercial air activity. Our heartiest congratulations to the makers of the "Cub," and to the makers of the "mystery" machine upon the honour of being the first to be allotted an engine of 1,000 h.p.

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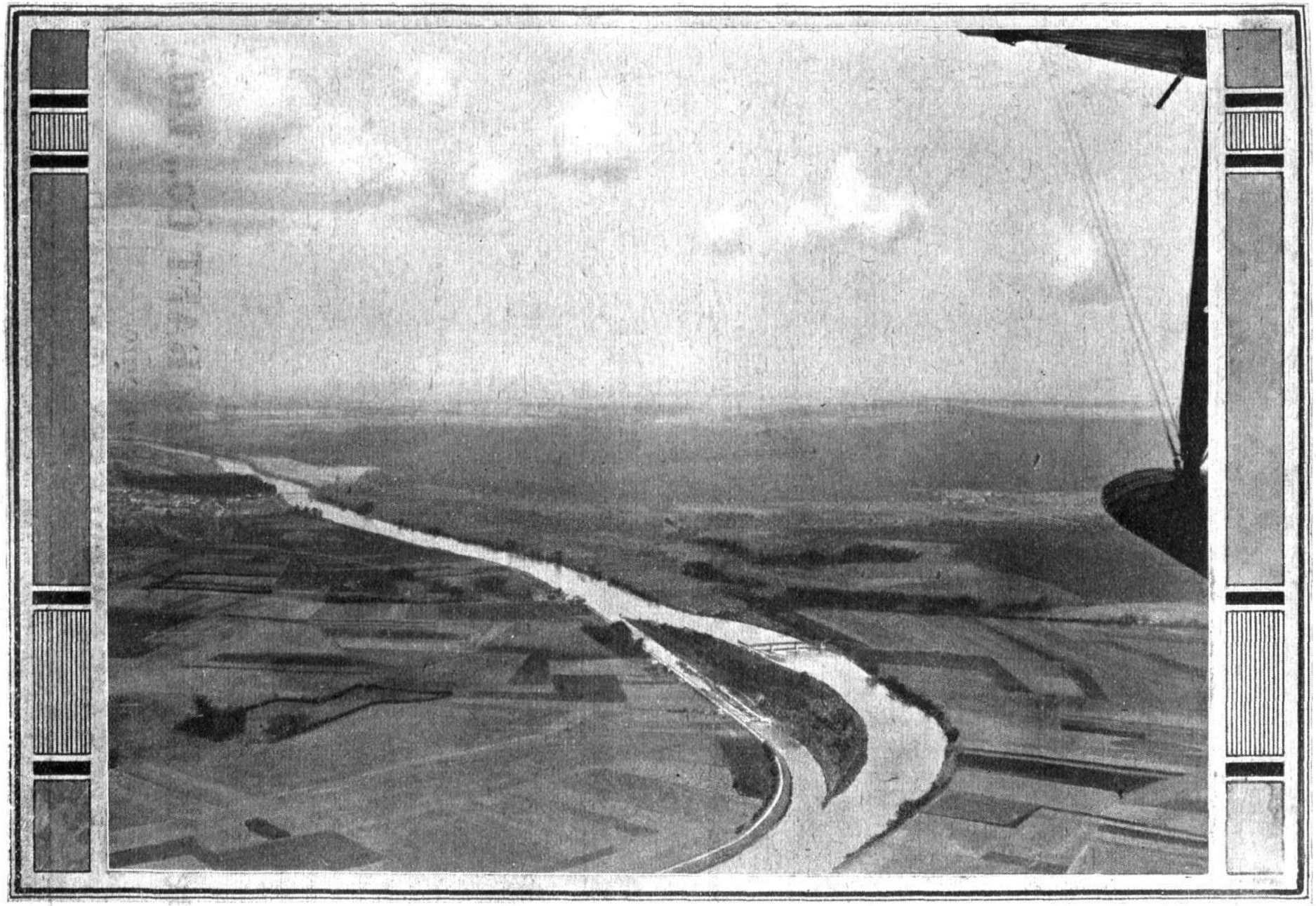
The "Roma" Wrecked.

As we go to press news comes to hand of an unfortunate airship disaster, at Hampton Roads, Virginia, to the U.S. semi-rigid "Roma," which was recently purchased from Italy. It is feared that the loss of life is about 30, there being only 10 survivors—the exact number of persons on board is not stated. The cause of the accident is not at present quite clear, but apparently her elevator broke, causing the airship to dive and crash into one of the buildings of the Naval Base. Some high-tension electric cables ignited the gas.

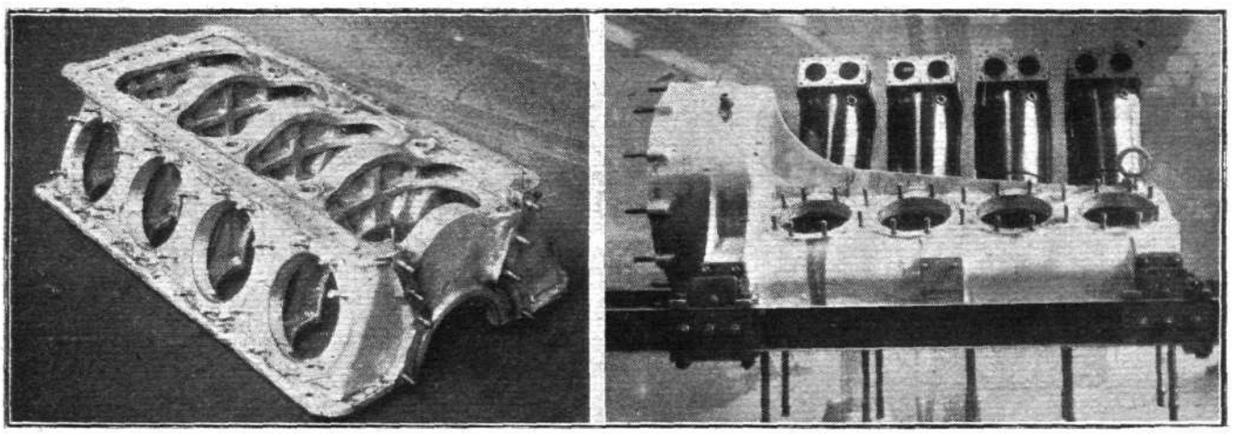


LONDON-PARIS FROM THE AIR, AS SEEN FROM A HANDLEY PAGE MACHINE:
No. 26.—The River Oise, near Beaumont

HARNESSING 1,000 HORSE POWER

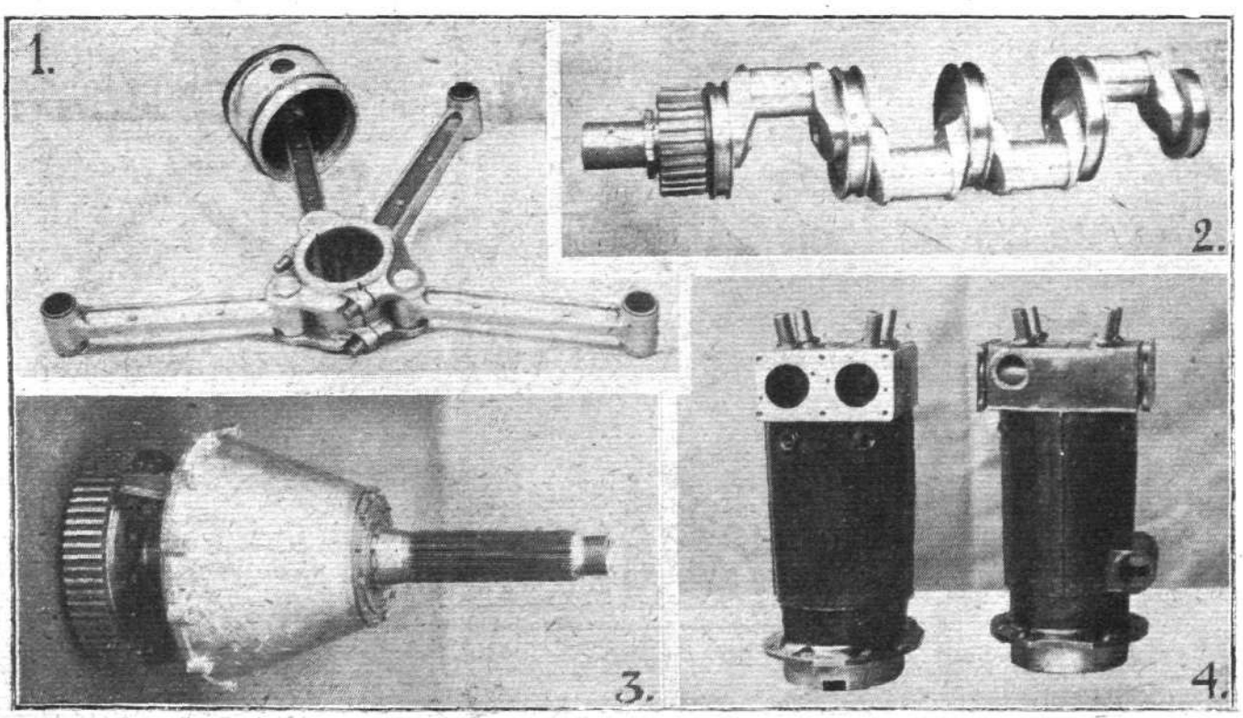
A Visit to the Napier Works

IT is probably no exaggeration to say that since the early days of flying, when the 50 h.p. Gnome rotary enabled the aeroplanes of that day really to fly, instead of making long "hops," no engine has won such rapid, and yet lasting, popularity as has the Napier "Lion" of modern times. And while on the subject of the Gnome, it is interesting too, to note that the main, or at any rate, one of the most important causes for this popularity, is low weight per horse power developed. Compared with other engines of that time, the 50 h.p. Gnome, was a featherweight. Indeed, it was without doubt the engine which made flying practicable. In modern times history is repeating itself in the Napier "Lion," which has, if not made flying possible, at any rate, made it approach more closely to being a commercial proposition. In his paper, read before the recent Air Conference, the Director of Research (Brig.-Gen. Bagnall-Wild) paid a warm tribute to the Napier "Lion." "It is only now," he said, "with the Napier 'Lion' engine, that on the cross-Channel services, it is possible to run on an average load of but 60 per cent. of the maximum." That, in a nutshell, is the secret of the startling success of this engine. It should be added, however, that lightness in itself, although a vastly important desideratum, is not sufficient to "make" an engine. Reliability, smooth running, low fuel consumption, etc., are also of importance, but when, as in the Napier, these features are combined with light weight, the result is an engine that is difficult to beat.



THE NAPIER "CUB": On the left, the bottom half of the crankcase. Note the substantial stiffening webs. On the right, the top half of the crankcase, with four cylinders in place, on the rotatable bench used for erecting the engine.

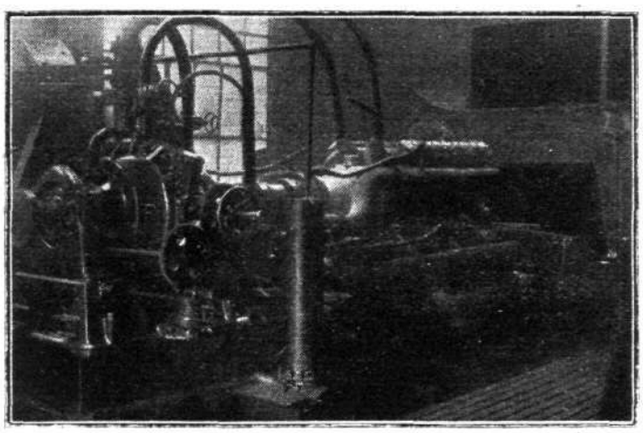
With that far-sightedness which has been characteristic of Napiers for a number of years, the firm was not content to rest on the laurels won with the Napier "Lion," and as soon as that engine had passed through its teething troubles, and been firmly established as a production job, the designers set to work to evolve a larger engine, incorporating many of the features which had been instrumental in making the



SOME CONSTRUCTIONAL DETAILS OF THE NAPIER "CUB": 1, Connecting rod assembly. There is one master rod and three auxiliary rods, one of which is attached to the big-end cap. 2, The crankshaft. Note the large roller bearings. 3, The reduction gear and propeller shaft. 4. Two of the cylinders. There are four valves in each.

"Lion" what it is, yet on account of its greater power differing essentially from that engine in many respects. The result was the 1,000 h.p. engine, which made its first appearance last year. Already that engine has won to the distinction of having a nickname, being affectionately known as the "Cub." This first 1,000 h.p. engine was illustrated and described in FLIGHT of February 10, 1921. On its first test that engine developed 1,057 b.h.p., and as its weight was approximately 2,200 lbs., it will be seen that it worthily maintained the Napier reputation for light weight.

Just recently the second "Cub," has been completed, and this was the occasion of a visit, by chiefs of the Air



The 1,000 h.p. Napier "Cub" on the test bench, running at about 1,200 r.p.m. When the photograph was taken the engine had not been running long, and was not yet allowed to run at full power.

Ministry and other influential personalities, on February 16, to the huge Napier works at Acton. Among those received by Mr. H. T. Vane, C.B.E., Managing Director, and Sir Harry Brittain, K.B.E., Director, were :—Lord Gorell, C.B.E., M.C., Major Sir Phillip L. Greame, K.B.E., M.C., Major-General Sir Frederick Sykes, G.B.E., K.C.B., C.M.G., Sir Wm. Joynson-Hicks, M.P., Major-General Sir Sefton Brancker, K.C.B., Sir Wm. Bull, M.P., Lieut.-Col. Moore-Brabazon, M.C., M.P., and Mr. A. Baldwin Raper, M.P.

The visitors were conducted over the works in parties, each under an expert guide, and thus had an opportunity of witnessing the actual production of the Napier aero engines. From beginning to end the Napier engines are made with the most minute care, all materials being subjected to chemical and physical tests before being allowed to be incorporated in the engines. In a well-appointed laboratory, chemists were at work with their retorts, ovens and other paraphernalia of the "lab," and in another part Izod, Brinell and similar physical tests were being carried on.

In the shops the visitors saw the different parts being manufactured on the most up-to-date machinery, and erected and assembled on special jigs and benches. It is impossible, in the space available, to give an idea of the innumerable operations necessary before a finished engine emerges and is taken to the test house for its running tests. Suffice it to state that everywhere the greatest possible care is being taken to ensure the excellent workmanship and superb finish for which the Napier engines are rightly famous.

Rows upon rows of Napier "Lions" were ready for shipment, many of them to foreign governments. Others were roaring in the test house. But among all the activity, the most interesting part, from the visitors' point of view, was, undoubtedly, the manufacture and testing of the mighty "Cub." With its cylinders arranged somewhat in the manner of a letter X, although the arms are not evenly spaced, the upper rows being placed at a smaller angle to each other than that which separates the lower rows, the "Cub" is of astonishingly short length, considering its power. The large cylinders have sheet steel water jackets welded on, and each cylinder has two inlet and two exhaust valves.

The aluminium crank case on which the cylinders are mounted, is strongly webbed for rigidity, as shown in one of our photographs, and carries at its front end the housing for the large reduction gear, which is also shown in a photograph. The connecting rod assembly is of interest inasmuch as there is one master rod, to which are attached the three auxiliary rods, one of them to the cap of the big-end.

The crankshaft, as will be seen from one of the photographs, is of ample dimensions, and runs on very large roller bearings. The manner in which these are slipped over the webs and crank pins into position, and locked, is highly ingenious, and must have taken a great deal of thinking-out. Owing to the size of the roller bearings, the peripheral speed must be very high, but we understand that no trouble whatever has been experienced from this source. The large size was necessitated by the insistence of the designers to have a crankshaft of such diameter as to ensure rigidity, and consequent smoothness of running and absence of wear and tear. That this object has been attained appears certain.

In the test house, visitors were allowed to witness a "Cub" on its first test. Owing to the fact that the engine had only been running for a few hours, it was not allowed to develop its full power. When we saw it the revs. indicator remained steadily on 1,200 r.p.m., with a short "burst" at about 1,650 r.p.m. We understand that full power is developed at about 2,000 r.p.m.

So far the "Cub's" achievements rest on what it has done on the test bench, but in the near future, in fact, probably by the time these notes appear in print, it will be mounted in an aeroplane designed and built by a famous pioneer firm of aircraft constructors for the Air Ministry. That it will give this machine an astonishing performance, we have no shadow of doubt. Details are not permitted, but we may say that we have seen the machine, and in our opinion, the power plant is worthy of its machine, and *vice versa*. It is not too much to say that the advent of a 1,000 h.p. single-power unit will mark a new milestone in aerial development, and

Visiting the Napier aero engine works at Acton: Our photograph shows Mr. H. T. Vane, Managing Director of the firm, conducting a party over the very extensive works. From left to right are seen: Lord Gorell, Mr. Vane, Gen. Sir Sefton Brancker, Sir Harry Brittain, and Lieut.-Col. Moore-Brabazon.

it is to be hoped that in the not too distant future this wonderful power plant will be given an opportunity of showing what it can do in a commercial machine. The number of passengers carried in a good high-performance modern aeroplane corresponds to a power expenditure of about 45–50 h.p. passenger. For the "Cub" this would mean about 20–22 passengers. Aeroplane designers forward. The Napier "Lion" has already done invaluable service to commercial aviation. We can express no better hope for the "Cub" than that it may worthily uphold the traditions of its smaller prototype.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

ANNUAL GENERAL MEETING

THE Annual General Meeting of the members of the Royal Aero Club of the United Kingdom will be held on Wednesday, March 29, 1922, at 3, Clifford Street, New Bond Street, London, W. 1, at 6 p.m.

Notices of motion for the Annual General Meeting must be received by the Secretary not less than twenty-one days before the meeting, and must be signed by at least five members.

COMMITTEE

In accordance with the Rules, the Committee shall consist of 18 members. Members are elected to serve for two years, half the committee retiring annually.

Retiring members are eligible for re-election.

The retiring members of the Committee are :—

Major-General Sir Sefton Brancker, K.C.B.
Ernest C. Bucknall.
G. B. Cockburn.
The Earl of Halsbury.
Col. F. Lindsay Lloyd, C.M.G., C.B.E.
Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P.
Lieut.-Col. M. O'Gorman, C.B.
Air-Commodore C. R. Samson, C.M.G., D.S.O., R.A.F.
Sir Mortimer Singer, K.B.E.

Any two members of the Club may nominate a member to serve on the Committee, provided the consent of the member has been previously obtained. The name of the member thus nominated, with the name of his proposer and seconder, must be sent in writing to the Secretary not less than fourteen days before the Annual General Meeting.

COMMITTEE MEETING

A meeting of the Committee was held on Wednesday last, February 15, 1922, when there were present : Brig.-Genl. Sir Capel Holden, K.C.B., F.R.S., in the Chair ; Wing-Commander W. D. Beatty, C.B.E., R.A.F. ; Mr. Ernest C. Bucknall ; Col. F. Lindsay Lloyd, C.M.G., C.B.E. ; Lieut.-Col. F. K. McClean ; Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P. ; Lieut.-Col. Alec Ogilvie ; Lieut.-Col. M. O'Gorman, C.B. ; Rear Admiral Sir Godfrey M. Paine, K.C.B., M.V.O. ; Mr. T. O. M. Sopwith, and the Secretary.

Election of Members.—The following new members were elected :—

D. W. F. Bonham-Carter.
C. J. Stone.

Civil Aviation Advisory Board.—Letter was read dated February 9, 1922, from the Air Council stating that it had been decided to establish a permanent Civil Aviation Advisory Board under the Chairmanship of the Under Secretary of State for Air, and requesting the Club to nominate a representative to serve on the board.

The Chairman of the Club (Brig.-Genl. Sir Capel Holden, K.C.B., F.R.S.) was appointed to represent the Club on the board.

International Air Conference, 1923.—The following were appointed to represent the Club on the Executive Committee to be formed, to organise the International Air Conference in London in 1923 :—

Col. F. Lindsay Lloyd, C.M.G., C.B.E.
Lieut.-Col. F. K. McClean.
Harold E. Perrin.

Schneider Cup, 1922.—The Secretary reported that the date for receiving entries had been extended to June 1, 1922.

F.A.I. Law Commission.—It was reported that the Law Commission of the F.A.I. would meet in Paris on March 13 and 14 to consider the various acts regulating Aerial Navigation in the different countries.

The Club's representative, Major E. H. Tindal Atkinson, being unable to attend it was decided to appoint Major R. H. Mayo to attend the Conference on behalf of the Club.

Flying Services Fund.—The report of the meeting of the Flying Services Fund Committee held on February 3, 1922, was received and adopted.

House Committee.—The report of the meeting of the House Committee held on February 13, 1922, was received and adopted.

Aviators' Certificates.—The following aviators' certificates were granted :—

7921 Nevill Vintcent (January 28, 1922).
7922 David William Frederick Bonham-Carter (December 14, 1921).
7923 Cecil John Stone (December 17, 1921).

Flying Services Fund.—A meeting of the Flying Services Fund Committee was held on Friday, February 3, 1922, when there were present : Lieut.-Col. Alan S. Dore, D.S.O., in the Chair ; Mr. Chester Fox, and the Secretary.

Eighteen applications for assistance were considered, and grants and allowances voted amounting to £220.

Gordon Bennett Balloon Race.—Entries for the Gordon Bennett Balloon Race, to be held in Geneva on August 6, 1922, close on Saturday, February 25, 1922. The following entries have so far been received :—

Lieut.-Col. John D. Dunville.
Mr. E. Allen.

THE FLYING SERVICES FUND COMMITTEE

(*Registered under the War Charities Act*, 1916.)

Administered by the Royal Aero Club.

For the benefit of Officers, Non-Commissioned Officers and Men of the Royal Air Force who are incapacitated while on duty, and for the widows and dependants of those who are killed or die from injuries or illness contracted while on duty.

Honorary Treasurer

The Right Hon. Lord Kinnaird.

Committee

H.R.H. The Duke of York, K.G. (Chairman).
Lieut.-Col. A. Dore, D.S.O.
Mr. Chester Fox.
Wing-Commander T. O'B. Hubbard, M.C., R.A.F.
Air-Commodore C. R. Samson, C.M.G., D.S.O., R.A.F.

Secretary

H. E. Perrin.

Bankers

Messrs. Barclays Bank, Ltd., 4, Pall Mall East, London, S.W. 1.

Subscriptions

	£	s.	d.
Total subscriptions received to June 20, 1921	17,252	0	4
H.R.H. The Duke of York, K.G.	21	0	0
Air League Orphan Fund	224	4	9
Total—February 20, 1922	£17,497	5	1

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

At the King's Levee

AMONGST those who attended the Levee held by His Majesty the King at St. James's Palace on February 14 were Air-Marshal Sir Hugh Trenchard, C.B., D.S.O., K.C.B., Principal Air Aide-de-Camp, General-in-Waiting, Capt. the Rt. Hon. F. E. Guest, C.B.E., Secretary of State for Air, Air-Comm. O. Swann, C.B., and Wing-Comdr. H. R. Busteed, O.B.E., A.F.C. Amongst those presented to the King were the following :—Sqdn.-Ldr. J. T. Babington, D.S.O., Flight-Lieut. T. G. Bowler, Flight-Lieut. F. L. Butcher, Sqdn.-Ldr. A. G. Carr, O.B.E., Flight-Lieut. W. S. Caster, M.C., Flying Officer J. L. Hughes-Chamberlain, Sqdn.-Ldr. D. C. Evill, D.S.C., A.F.C., Flight-Lieut. A. Garrity, Sqdn.-Ldr. H. A. Hewat, Flight-Lieut. V. J. Jacobs, Flying Officer H. P. Leigh, Flight-Lieut. C. Musgrave, A.F.C., Flying Officer H. C. Pyper, Flying Officer I. M. Rodney, Wing-Comdr. H. W. Scott, Flight-Lieut. F. H. Sims, Flying Officer J. F. Titmas, Flying Officer E. A. Locke-Waters.

FLIGHT

THE AIR CONFERENCE, 1922

[OWING to lack of space, it has not been found possible to print the last three papers read before the Air Conference as fully as we could have wished. In the abstracts and *résumés* which follow, we have endeavoured to retain all the more important points raised by the various lecturers, and at the end of the three technical papers will be found a brief report of the discussions which took place during the afternoon session of the second day of the Conference. We understand that the Air Ministry intends to publish the proceedings of the Air Conference in full, and that the official report will probably be published some time during March. We would recommend those who wish for fuller reports than those which we have been able to give to obtain a copy of the report.—ED.]

RESEARCH FROM THE DESIGNERS', CONSTRUCTORS' AND USERS' POINTS OF VIEW

By Major FRED M. GREEN, O.B.E., M.I.C.E., F.R.Ae.S.

IT is easy to make suggestions for research in every direction and to state a list of questions that would involve many years of work using all our existing facilities. In the hope of making this paper of some immediate value, I propose to confine myself to suggesting lines of research from which an immediate and substantial return may be expected. Research of this type is not always of fundamental importance to the science of aeronautics. I wish to say that I am definitely not in favour of abandoning the more abstract research, or indeed of relegating it to a second place in our programme, for in the long run it will probably yield results of infinitely greater importance than are likely to be the outcome of the special investigations I shall suggest; but from the designers', constructors' and users' point of view, it is in research of the latter type that the chief interest lies.

Immediate Problems Involved

Wing Surface.—From many points of view it is an advantage to use the least amount of wing surface that will give the results required. Smaller wings mean lower first cost, less weight, and less up-keep. The designer wants information as to the characteristics of various wing sections, and also of various shapes and arrangements of planes, and is at once face to face with the question of how to apply wind channel results on models to full size aeroplanes. It seems to me that this is the burning question of the day, and that until designers can be shown how to use wind channel results on wings, and until they can be convinced that the results can be used without the chance of serious error, it is of little use suggesting further wind channel research on new kinds of wings. It will be better to devote all the available energy and talent to clearing up this problem than to amass results, the value of which is unknown.

A great deal of full-scale work has been done in testing aeroplanes at the Royal Aircraft Establishment and at the Royal Air Force Experimental Stations at Martlesham Heath and elsewhere. Unfortunately these tests cannot by their very nature be as clear cut as wind channel tests, nor have the results the same kind of accuracy. A large number of corrections and allowances for various disturbing factors have to be made. The expense also of the work is very high. At the same time, the results obtained really do apply to wings of a scale in which we are interested, and the figures inspire in the designer more confidence than do wind channel results, which he does not know how to interpret. For many years experiments have been made with a view to obtaining the resistance of the aeroplane by measuring the thrust or pull of the airscrew. Considerable difficulties were at first found in getting accurate results. It will be of great value if this work is continued, and if full-scale tests on the same aeroplane fitted with different sorts of wings can be made and the results published as soon as possible after they are obtained. The results can be checked by making gliding experiments, although the thrust-meter method is likely to prove the more useful. The aeroplane used for this purpose need not be large or expensive, and it certainly seems that every effort should be made to establish a connection between full-scale and model results for some typical aerofoil such as R.A.F. 15.

Another question in which the designer is concerned in fixing the size of the wings, is how much of the maximum available lift the pilot will be able to use; that is to say, at how near the minimum speed will he be able to fly without risk of losing control. Research work on control at low speeds is certainly needed; part of this, I think, can well be carried out in the wind channel in close co-operation with full-scale experiments. The cause of the most usual form of flying accident, generally known as a spin, is bound up in this question, and it seems not unlikely that one of the greatest dangers of flight may be removed when we have more knowledge of the subject. The size of the controlling surfaces, namely the elevator, tail plane and wing flaps, are all affected by the characteristics of the planes, but again we must know the relation between model and full scale in such matters as the travel of the centre of pressure before we can use model results with certainty.

Power Required.—In estimating the power required for an aeroplane, it is necessary to add to the drag of the wings the resistance of the body, struts, wires, landing gear, and other parts external to the wings. This is work which can well be done in the wind channel, and there is every reason to believe that the results of such work can be applied to full scale work without much error. Knowing the total resistance of the aeroplane, the power required can be settled when we know the efficiency of the propeller. This is a matter on which research is needed, particularly on the efficiency of the propeller in relation to an aeroplane body. Another matter which affects the resistance of an aeroplane is the power used in cooling the engine. We are still uncertain whether it takes more power to cool an air or water-cooled engine, and in the case of radiators we are quite at variance as to their most economical arrangement.

Materials for Aeroplanes.—A good deal of work has been done on the characteristics of wood, and as this material is subject to such wide natural variations it does not seem that further research will be of much help. So long as wood is used, the making of good aeroplanes will be a matter of art rather than science. In the covering for aeroplane wings, nothing has yet been produced to compete seriously with linen or cotton fabric treated with suitable dope and protective covering. It certainly would be an advantage if this could be replaced by metallic covering, but such covering must not be of greater weight per square foot and must have reasonable resistance to tearing.

Metal Construction.—The substitution of metal for wood may enable us to effect improvements in weight. Using steel of 45 tons per square inch tensile strength, it is possible to make aeroplane structures of at least no greater weight than those of wood. The use of steels of higher tensile strength should enable us to make them lighter. The present difficulty is that in order to make parts suitable for aeroplanes the thickness of the material has to be small, and we have yet to find out the best methods of making and using thin sheet materials. Many of the fundamental principles have been established, and the development of this sort of work calls for research of rather a practical nature.

Calculations of Stresses.—The method of calculating the stresses in an aeroplane structure has been gradually improved. The present methods standardised by the Air Ministry more nearly represent the actual case than those used in most other branches of engineering. At the same time a number of assumptions are made for the purpose of simplifying calculations which are not strictly accurate, particularly in neglecting redundant members. It is generally assumed in the calculations that the incidence bracing takes no load. In actual flight it always does take a share of the load, and the result is generally to make the aeroplane somewhat stronger than calculations show.

Problems of the Engine Designer.—The success of an aeroplane depends largely upon the performance and reliability of the motor that drives it. The reliability of the motor is to a very large extent bound up with the reliability of the materials that are used in its construction, while the weight per horse power that can be obtained depends upon the stresses to which the materials can be safely worked. The properties of high tensile steels are fairly well known, but engine designers are forced to reckon on a tensile strength far below that which they know can be obtained.

Aluminium alloys enter largely into the construction of most aeroplane motors, principally in the cast state. Obtaining reliable castings is a difficult matter, and we have always to use castings of a weight considerably in excess of what is necessary for strength in order to compensate for their possible defects. We also use an alloy which is at least 10 per cent. heavier than we need, because the foundries find

difficulty in making sound castings of known lighter alloys. The need for research seems to be obvious, but it must be a sort of research that will help to produce the castings required, and not merely to make sample test pieces of some particular material. Some of these aluminium alloys are required to maintain their strength when hot, and consequently their behaviour at temperatures above the normal must be investigated.

The amount of power that a petrol engine can give is frequently limited by the speed at which it can run. This in turn is sometimes limited by the risk of failure of the bearings. Very little indeed is known of the properties of plain bearings under the condition in which they have to work in an aeroplane motor. It is generally considered that the criterion of safety of a bearing is obtained by multiplying the average pressure by the rubbing speed, and if the result obtained is lower than a certain figure the bearing will be satisfactory. On the other hand, the designers of the Michell bearing assure us that the higher the rubbing speed the higher can be the load per square inch. Here we have two opinions which are diametrically opposed, and it certainly needs research in this direction to enable designers to fix their bearing surface with some degree of certainty. The properties of ball and roller bearings also need investigation, as there is much uncertainty amongst designers as to their most suitable form and the loads that can be carried.

Fuels.—The type of fuel that is used in a petrol motor has a considerable effect upon the working of the motor. We know that the addition of benzole to petrol enables us to increase the compression of the engine without fear of detonation, and that other materials can be added to give similar results. Research is needed to determine the most suitable fuel that can be obtained at a commercial price and in commercial quantities.

Research for Constructors

Aeroplanes.—One of the most important processes with which the constructor is concerned is the joining of materials together, particularly the gluing of wood and the soldering, brazing and welding of metals. There is still no waterproof glue that is altogether satisfactory, and although much work has been done on the subject there is room for further research. The methods of soldering, brazing and welding have always been largely shop processes. There is little information to be had on the subject, and as these three methods are constantly used by all aeroplane constructors, further knowledge would be of advantage. Fluxes in particular call for attention, especially to determine which are easily useable and do not set up corrosion.

There is another peculiar problem which constantly presents itself to the aeroplane maker. It is to make stiff light forms of various shapes suitable for fairing which are weatherproof and, if possible, fireproof. In the general way the strength of these parts is unimportant; the chief requirement is that they shall keep their shape.

Engines.—The making of aeroplane engines presents a variety of problems in the shops. In the general way it is much easier to machine parts to the required degree of accuracy than to be certain that the material of which they are constructed is of the required strength and free from faults. The need for steels of uniform quality and of higher tensile strength has already been mentioned. The constructor is particularly concerned with the correct heat treatment of the material that he receives. Included in the heat treatment of metals must be case hardening, particularly of intricate parts. The life of most aero engines could be improved considerably if certain parts were specially hardened. This is not done on account of the difficulty of knowing that the hardening will be carried out in a manner which will not injure the rest of the part. Here I think is a large field for investigation, but it is of a practical rather than a theoretical nature.

Research for the User

The requirements of the user in the matter of research naturally apply to the actual operation of aeroplanes. Many of his problems would be removed or at least made easier by the researches already indicated, but certain of them are apt to be ignored both by the designer and the constructor. One of the most important of these is safety from fire both in flight and in case of accident.

Safe landing in small aerodromes is likely always to be of interest to the user, who very naturally objects to paying more rent for his ground than is necessary for safety. The research already suggested in connection with control at low speeds is possibly the most important factor of landing in small aerodromes, and probably more advantage will be gained by a knowledge of this subject than by the use of wings of an abnormally high lift coefficient. Landing gears in the general way offer possibilities of improvement, but this is rather a matter of individual design than of any particular research.

Alighting on Water.—There are many countries in which it is difficult, if not impossible, to find ground suitable for aerodromes, but where there is plenty of water which can be used for the purpose. In some cases it is convenient to have aeroplanes which can make use either of land or water for alighting or getting off. We have a fair knowledge of properties of floats and hydroplane boats. There is no doubt that this knowledge might be extended by further research. In the construction of boats and floats we still have a lot to learn, but this will probably have to be a matter of direct experiment.

The user is much interested in the comfort of his passengers, and in this matter the silencing of the engine and of the airscrew is of importance. The silencing of engines is fairly well understood, but involves in general a rather heavy expenditure of weight. The silencing of airscrews is more difficult, and perhaps the problem could better be solved by placing the passengers in cabins which are more or less soundproof. The subject is one on which little is known, and research might indicate methods of improvement.

Meteorology.—The user is interested in weather prediction, more especially in anything that will affect visibility, such as fog and snow. He also wishes to have reasonable warning of dangerous extremes of weather, particularly in countries which are liable to violent storms. He is also interested in knowing the direction and strength of the wind at various heights, so that he may economise time and money by taking advantage of favouring air currents and in avoiding those which are unfavourable.

Navigation.—The question of navigation presents no difficulties so long as the visibility is good. There are many reasons why it is not convenient to fly always in sight of the ground. When the wind is favourable it will generally pay to fly high, and it is certainly more pleasant to be in the sunshine above the clouds where the air is almost always steady, than to be tossing about just beneath them.

There are many ways in which wireless telegraphy and telephony can help, but it is essential that the gear carried on the aeroplane shall be as light and as simple to use as possible. Wireless control of the aeroplane itself, from the ground, is certainly a possibility of the future, and it may be that the pilot of an air liner will give up the control of the aeroplane when within certain distance of his landing place to a ground pilot, who will bring the aeroplane into port.

Multi-Motor Aeroplanes.—In running an air service it is essential that forced landings of any sort shall be as infrequent as possible. If we could absolutely cut out the chance of motor failure we should practically achieve this end. Aeroplanes have been made in which the power unit has been divided up into any number of motors up to six, but for many reasons the single motor aeroplane is still, in practice, as reliable as the multi-engine machine. There is certainly room for research in this direction, and it will probably need close co-operation between the engine designer and the aeroplane designer if a solution is to be found.

Conclusion.—The high position that this country holds in the development of flying is, I think, due almost entirely to the wisdom of the Government that set up an Advisory Committee and instituted research work at the very beginning of flying. The work carried out at the National Physical Laboratory, the Royal Aircraft Establishment and the Testing Stations of the Royal Air Force, could not possibly be done by private enterprise, and it is by the information gained and the standard set by this work that the industry is enabled to produce aeroplanes which cannot be rivalled in any other country.

It is the opinion of the writer that help of this kind is of greater value than direct subsidy, and he earnestly hopes that even the pressing need for economy will not prevent research being carried out in the future in the same spirit as it has been carried out in the past.

THE PROGRESS OF RESEARCH

By Brig.-Genl. R. K. BAGNALL-WILD, C.M.G., C.B.E., F.R.Ae.S., Director of Research

ALTHOUGH extremely interesting, the restrictions of space prevent publication in full of the paper read before the Air Conference by the Director of Research. It is hoped, however, that in the following *résumé* no points of primary importance have been omitted. The Director of Research prefaced his paper with some general remarks upon research

and experiment, pointing out that the Directorate of Research is an engineering as well as a scientific organisation. He mentioned the valuable work being done at our various universities in addition to that carried out at the N.P.L. and R.A.E., and the full-scale work and testing at Martlesham, Isle of Grain and certain other air stations.

Aero Engine Research

The General stated that the biggest technical problem affecting civil aviation is the development and perfecting of the aero engine, and called attention to the difference of the working conditions of a car engine and an aero engine. The former is not normally run at more than one-third of its full power, whereas until the advent of the Napier "Lion"—which has enabled machines to fly on an average loading of 60 per cent.—it was customary for aero engines to be run at from 80 to 100 per cent. of their full load. As regards future development, it was very encouraging to find that the new Director of Research does not entertain any great hopes of success being attained either with the internal combustion turbine or the steam turbine, encouraging because, we think, it would be a mistake to expend money and energy in pursuing research on subjects which give so little promise of success.

Direct Injection.—The lines upon which the Director of Research indicated that research is being conducted are on direct fuel injection and air-cooled cylinders. As regards the former, the General stated that experiments are in hand to determine whether it is better to replace the carburettor system by some method of direct injection, and that Dr. Ferranti is attempting this on a Tuxham two-stroke engine. At the R.A.E. experiments are being made, with Professor Hawkes' assistance, on the possibility of employing shale oil and operating engines on the Diesel cycle. A single cylinder engine from an ordinary Otto cycle aero engine is being used, and it is hoped to run up to an engine speed of 1,000 r.p.m. At the R.A.E. work is also proceeding on the solid injection of a fuel consisting of 95 per cent. of alcohol. The Director of Research summarised the advantages which it is considered should accrue from the use of direct injection, as follows: (1) high flash point fuel could be used, thereby reducing fire hazard; (2) cheaper fuel; (3) higher compression ratios, and therefore better fuel economy; (4) fuel supply to engine more positive than when it depends on small heads, and is liable to be upset by small particles of dirt; (5) the elimination of the ignition system would remove a source of unreliability and trouble; (6) as air only is compressed, the way is opened up to an economical two-stroke engine, with its advantages of more even torque for a given number of cylinders, and probably less weight per b.h.p. By using a suitable air compressor of greater capacity than that necessary for normal two-cycle working, a supercharging engine would be obtained as a straightforward development. In connection with supercharging, the General mentioned the air compressor turbine driven by the engine exhaust, and stated that experiments on superchargers are being conducted at the R.A.E. He also referred to the altitude test house at Farnborough, in which engines can be tested under conditions corresponding to those obtaining at great altitudes. Finally the lecturer referred to the assistance given to engine testing during flight by a method suggested by Professor Callendar, and stated that the use of this apparatus and of the new R.A.F. thrust meter should enable far more complete air tests to be carried out than have hitherto been possible.

Air Cooling.—Gen. Bagnall-Wild then referred to the question of air cooling and its advantages; mentioning that the staff at Farnborough have long been of opinion that this was a possible development, and we now have the Bristol "Jupiter" radial air-cooled and the Siddeley "Jaguar," also a radial air-cooled, while in some other tests a single cylinder, air-cooled, has given as much as 222 b.h.p. with a brake mean effective pressure of as much as 134 lbs./sq. in. There are, the lecturer stated, enthusiasts who consider that an air-cooled engine of 1,000 h.p. should not be impossible of attainment, and that with one or other form of cooling an aero engine of 2,400 h.p. at 750 r.p.m. should be possible.

While on the subject of air-cooling, the General mentioned that there is a point which is frequently overlooked when considering the relative weights of air-cooled and water-cooled engines. Although in the former type the weight of radiator and water is saved, the weight of air-cooled cylinders and pistons is greater than that of water-cooled. Thus it was found that, although the gain due to elimination of radiator, water, pipes and pump was about 0.7 lb. per h.p., the excess in cylinder and piston weight of the air-cooled amounted to 0.46 lb. per h.p., so that the net gain was only 0.24 lb.

As regards single-engine *versus* multi-engine arrangement, the Director of Research pointed out that, quite apart from other relative merits, the single-engine installation usually scores as regards the weight of its accessories. From a number of typical cases it was found that the accessories for a twin-engined arrangement weighed about 1.3 lb./h.p., and for the single-engined installation about 1.0 lb./h.p. For an air-cooled engine the figure for a single engine would be nearer 0.4 lb./h.p.

Silence.—On the question of silencing, the lecturer stated that the two main offenders appear to be the engine and propeller, of which the former is the easier to deal with. He was glad to be able to state that experiments had proved that the simplest form of all silencers had proved as effective as any. This consists of adding to the exhaust manifold a tube of about three inches diameter, perforated with some hundreds of holes each one-eighth of an inch in diameter. This tube runs almost the whole length of the aeroplane. As there are no baffles the back pressure is very slight, and the revolutions are reduced by about 5 r.p.m. only, while the weight, for a machine like the D.H. 9 or Bristol Fighter, is only about 25 lbs. The General did not see any probability of any extensive reduction in propeller noise, although experiments are in hand which may assist in reducing to some extent the noise made by the airscrew. While on the subject of aero-engine research, the General paid a warm tribute to the work of the late Maj. Norman, of the R.A.E., whose immense personal courage, especially in testing the effects and prevention of fire, was of the greatest value to air research work.

Navigation

Clouds and Fog.—The most difficult problem in connection with air navigation, the General stated, is the provision of means for enabling an aircraft to locate its aerodrome and alight safely on it in misty or foggy weather. Professor Lindemann had suggested that the best means of landing in a fog might be the provision of two pairs of kite balloons floating above the cloud layer, the first pair being at such an altitude as would enable a gliding machine passing between them also to glide between the second and lower pair, and, after an equal interval of time, to land on the aerodrome. In connection with flying in clouds or fog the lecturer referred to the gyro turn indicator, which has proved to be more sensitive and much more rapid in its indications than any other method tested so far. Unlike the constant azimuth gyro, this apparatus does not need to be delicately balanced as regards the position of its centre of gravity, and it is therefore remarkably fool-proof. As regards compasses, the lecturer mentioned that the work at Farnborough had indicated the great advantage of a long period, while the work of later inventors showed the advantage of damping the oscillations, even to the point of a periodicity.

For navigation, when flying out of sight of land, the necessary instruments to enable the position to be determined by the ordinary methods of nautical astronomy are now available, and the probable error should not be more than 10 miles, which is considered sufficient for ordinary air work.

Wireless.—A particularly promising form of wireless aid to navigation is the rotating wireless beacon, which offers freedom from the troublesome quadrantal error, but it depends for its ultimate accuracy upon a careful study of the conditions which determine the nature of the path followed by the waves.

Machines

Stability.—In connection with stability, the Director of Research stated that inherent stability, when attained, greatly reduces the need for automatic stability apparatus of a more or less complicated nature. He thought that, if possible, one of the wind tunnels at the N.P.L. should be devoted entirely to stability work, especially to problems of lateral stability.

While dealing with the Handley Page slotted wing, the Director of Research stated that on flying tests with a D.H. 9 *fuselage* and a slotted wing, the climb was 1 in 7.2 as against 1 in 10 when the machine was fitted with ordinary wings. He also referred to the "Alula" wing, but stated that so far wind-tunnel tests have not demonstrated this form of wing to be exceptionally good. Scale effect might prove unusual in this form of wing, and this point was, he said, being looked into.

He also referred to the question of metal propellers and variable pitch propellers, and to helicopters. Regarding the Brennan the General stated that this helicopter had flown to the extent of lifting the pilot and 250 lbs. of useful load.

The General referred to the Air Ministry tank tests, but did not give any information as to the results obtained.

Materials

In dealing with the question of materials, the lecturer referred to the work of the Materials Sub-Committee, and

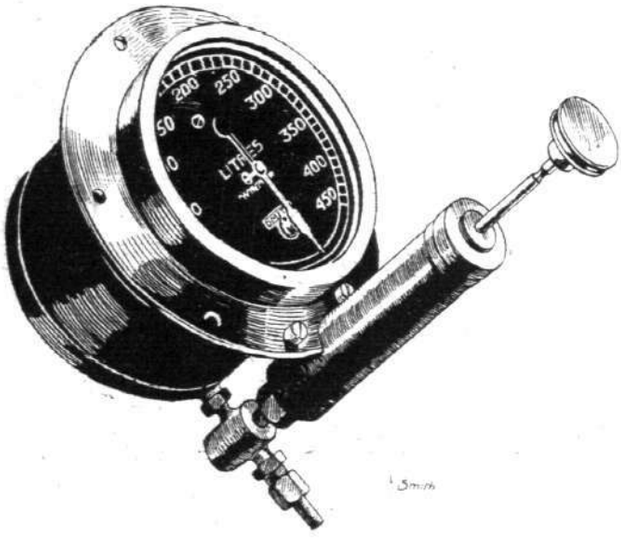
stated that it had been shown that we should get into the habit of thinking of fatigue limits rather than of ultimate stress limits. The great difference between these two, he said, is seen in the effect of a tool mark or a scratch on, say, a crankshaft. Under an alternating stress the sensitive area is pulled to and fro until an appreciable portion of the shaft is weakened. Tests on the fatigue of materials are being carried out at the Universities at Leeds, Edinburgh, Bristol and Birmingham, in addition to researches at the National Physical Laboratory and elsewhere.

The Director of Research spoke in praising terms of the new Blaisdell "Petroflex" for petrol piping, and stated that fifty sets have been sent out to the East to be tested under conditions which have been found to ruin rubber piping in six months.

Turning to the question of timber supply, the lecturer stated that Canada is now supplying spruce so carefully selected that it seems not unlikely that over 80 per cent. will be found to comply with our best quality specifications.

THE SMITH PETROL LEVEL INDICATOR

IT is, perhaps, a remarkable fact that in the past the very important question of providing a means of informing the pilot of an aeroplane as to the state of affairs within the petrol tank was either ignored entirely or else complied with in not an altogether satisfactory manner. We well remember the happy days when it was general practice to unscrew the cap of the petrol tank, insert a length of stick—together with any foreign matter adhering thereto—and ascertain the quantity of petrol *in situ* by the wet mark left on the stick after withdrawing it; whilst some of the devices put forward for indicating the petrol level were somewhat complicated and more or less unreliable.



THE SMITH PETROL LEVEL INDICATOR: General view of the instrument itself, which is given a neat black finish.

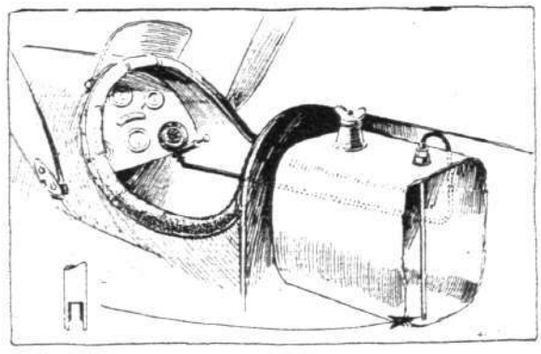
Now, however, thanks to the efforts of Messrs. S. Smith and Sons (M.A.), Ltd., of Central Works, Cricklewood, London, the well-known manufacturers of motor accessories and instruments, there exists an instrument, which may be fitted on the usual instrument board, that indicates the exact—or as near exact as really matters—amount of petrol in the tank at all times.

Apart from being extremely reliable—which is testified by the fact that it is a standard fitment on all Vickers machines, whilst most of the Air Ministry contracts now call for one of these instruments—the most important feature of the Smith petrol gauge is its extreme simplicity, both in operation and in construction.

It consists of two portions—the indicator itself, which is mounted on the instrument board or any other convenient position, and the piping and tank connection. The indicator is uniform in style and finish with the various other Smith instruments—air speed, engine revolutions, etc.—and contains a very sensitive pressure gauge working on much the same principle as the Smith air speed indicator; that is, it is fitted with a flexible diaphragm, made of specially doped silk, which forms one side of an air chamber, to which connection is made at the back of the gauge to a tube running from the bottom of the petrol tank. This tube is open at its lower extremity, and the connection with the indicator is made with the usual piping. The diaphragm is, of course, connected through suitable mechanism to the pointer of the indicator.

The operation of the gauge is as follows:—When the petrol tank is filled up with petrol a certain amount of the liquid rises up the pipe, compressing the air imprisoned within the tube, piping and air chamber of the indicator. This causes the silk diaphragm to expand, thereby moving the pointer round a given number of degrees proportional to the amount of petrol in the tank. It will be seen, of course, that the position of the instrument and the petrol tank relative to each other is a matter of minor importance; the tank itself can therefore be higher or lower than, or some distance away from, the actual gauge on the instrument board. This fact, together with the extreme simplicity of the whole system, is of very considerable advantage in an instrument of this kind, and the only trouble that can possibly occur is that after a bad landing there is just a chance that superfluous petrol might be forced up the pipe, causing the gauge to read higher than normal. This trouble is remedied, however, by arranging a small hand-pressure pump fitted at the base of the instrument, a few strokes of which expel all the petrol from the tube in the tank, allowing it to rise again to exactly the correct amount necessary to give an accurate reading on the instrument.

In the case of pressure-fed tanks a static pipe is fitted to the opposite side of the diaphragm and arranged to project into the top of the tank. With regard to the tube itself, the end of this is slotted so that the tube may be pressed hard against the bottom of the tank and ensure that if it is ever



THE SMITH PETROL LEVEL INDICATOR: Diagrammatic sketch showing the general "lay-out" of the system.

removed at any time for adjustment it will always be returned to exactly the same position.

The method of calibration is as follows:—Messrs. Smith and Son send out instruments with a blank dial which is calibrated on the machine itself by filling up the tank with petrol, two, four or six gallons at a time, according to the size of the tank. The gauge is then returned to the makers, who engrave the dial and finish off the instrument. Naturally, any difference in the specific gravity of the petrol will affect the reading of the instrument, and it is, therefore, necessary when calibrating the gauge to note the grade of petrol that will be used on the machine.

In addition to being absolutely invaluable for aircraft work, the Smith type of gauge is adaptable for use on reservoirs, storage tanks, etc., and a big future is pretty well certain for it.

Enquiries should be sent to the manufacturers, Messrs. S. Smith and Sons (M.A.), Ltd., Aviation Department, Central Works, Cricklewood, N.W. 3, who will furnish blue prints and illustrations if requested.

Roland Rohlfs Joins Aeromarine Co.

ROLAND ROHLFS, the famous American pilot who has several flying records to his credit, has joined the Aeromarine Airways, Inc., and will take an active part in that company's flying-boat operations between Florida coast resorts and points in the West Indies and the Bahamas.

FLIGHT
THE AIRCRAFT ENGINEER

THE LONDON-CONTINENTAL SERVICES

FLIGHTS BETWEEN FEBRUARY 5 AND FEBRUARY 18, INCLUSIVE

Route‡	No. of flights*	No. of passengers	No. of flights carrying Mails	No. of flights carrying Goods	No. of journeys completed†	Average flying time	Fastest time made by	Type and (in brackets) Number of each type flying
						h. m.		
Croydon-Paris	43	81	17	38	40	3 4	D.H. 4 G-EAWH (2h. 9m.)	B. (4), D.H. 4 (1), D.H. 18 (3), G. (5), H.P. (1), Sp. (6).
Paris-Croydon	43	77	10	35	40	2 34	D.H. 4 G-EAWH (1h. 54m.)	B. (4), D.H. 4 (1), D.H. 18 (3), G. (5), H.P. (1), Sp. (6), V. (1).
Totals for 2 weeks ...	86	158	27	73	80			

* Not including "private" flights. † Including certain journeys when stops were made *en route*.
‡ Including certain diverted journeys.

Av. = Avro. B. = Breguet. Br. = Bristol. Bt. = B.A.T. D.H.4 = De Havilland 4, D.H.9 (etc.).
F. = Fokker. Fa. = Farman F.50. G. = Goliath Farman. H.P. = Handley Page. M. = Martinsyde. N. = Nieuport.
P. = Potez R. = Rumpler. Sa. = Saimson. Se. = S.E.5. Sp. = Spad. V. = Vickers Vimy. W. = Westland.

The following is a list of firms running services between London and Paris, Brussels, etc., etc.:—Co. des Grandes Expresses Aériennes; Handley Page Transport, Ltd.; Instone Air Line; Koninklijkie Luchtvaart Maatschappij; Messageries Aériennes; Syndicat National pour l'Étude des Transports Aériens; Co. Transaérienne.

LONDON TERMINAL AERODROME

Monday Evening, February 20, 1922.

WE have had one or two "dud" days from a weather point of view, but, generally speaking, the whole business of the "airway" is looking up, and indications are not wanting that the worst of the winter "slump" is over.

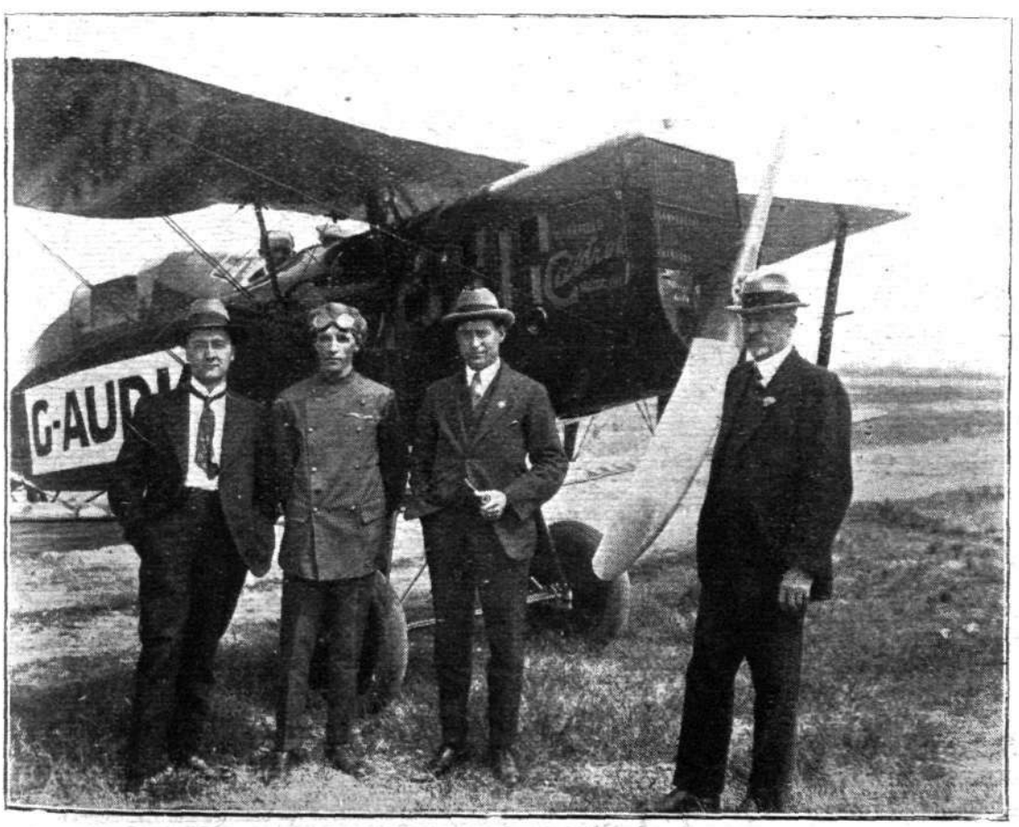
Mr. Priestley, who is still engaged on business in connection with the winding up of Aircraft Transport and Travel, was at the aerodrome on Friday, and with Major De Havilland —over from Madrid on a visit—was examining the D.H.16's, which are still stored in a couple of the temporary hangars. It is rumoured that a Spanish company have purchased these machines for use on services which are to be started in Spain this spring.

It is understood, incidentally, that Mr. Priestley will be on the staff of the Daimler Hire Air Service when operations are commenced on April 3. This morning the contractors began work on the new offices for this air service. These are situated exactly opposite the Instone Air Line offices on the main approach to the aerodrome.

Preparations for a Busy Season

THERE is a general "hustle" throughout the aerodrome, both on the part of the transport firms and Air Ministry, to furbish everything up in readiness for the coming season. New offices are being erected on all sides. Old ones are being touched up and painted. Various alterations are being made to the drainage of the roads on the aerodrome. The entrance and exit gates are being set back, and the entrance widened to allow of a better view of approaching traffic as the cars enter and leave the aerodrome.

The old aerodrome on the hangar side of Plough Lane is being ploughed up for cultivation, and this has meant the relinquishing of the sports ground—a bitter pill for those



Air Mail in Australia: The Geraldton to Derby air mail service is extended periodically to Perth, W.A. Our photograph is of interest as a souvenir of the first flight made. The machine is a Bristol Tourer with Siddeley "Puma" engine, and the names of the four gentlemen standing in front are, from left to right: J. A. Dimmit, W. Australia Agent for C. C. Wakefield & Co.; Major N. Brearly, D.S.O., M.C., pilot; C. L. Westcott, and Mr. Durack, whose territory in N.W. Australia is of greater extent than the area of Great Britain. Mr. Durack was the first passenger carried.

who put so much labour into the making of the cricket pitch last summer.

In connection with the handing back of this land to the farmer, the last remnants of the airship mast are to disappear. These consist of something like 100 tons of concrete which was sunk into the ground to form a base for the mast, and also for the stay-wires. Up to the present a couple of men with sledge-hammers and chisels have been "nibbling" at it, but have made little impression, and, at the present rate of progress they will probably be still on the job when airships are resurrected—that is if they live long enough. It is suggested that dynamite is the only reasonable solution to the problem of removing this mass of concrete.

The meteorological office is erecting more instruments. An automatic wind-gauge is being constructed as near as possible to the present wind-balloonette, in order that all high objects on the aerodrome shall be grouped in as small a space as possible. This instrument, worked on the pitot tube principle, records continuously on a chart the wind speed and direction. In the enclosure round the meteorological hut a German range-finder, still in full war-paint and camouflage, has been fixed up, and, as far as can be gathered, this is to be used for pilot balloon work in finding the speed and direction of the upper winds.

A Further "Cut" in Freight Rates

HANDLEY PAGE TRANSPORT have just reduced their freight rates, which are now as low as 5*d*. a pound for heavy parcels. It is expected that other firms will follow this "cut." There is to be a great "push" in connection with goods transport this year. All the companies, in fact, are making preparations to deal with a large amount of such traffic.

The Handley Page people have introduced luncheon baskets which, packed with good things, can be obtained by passengers before starting an air journey for consumption while in flight.

On Sunday two remarkably good flights were made by Messrs. Holmes and Courtney. Both were flying D.H.18's from Paris to London, and the weather was far from good. Wireless played a very important part in bringing them home, as they found on several occasions that they were being carried off their course by the wind.

Mr. Derwent Hall Caine's Renault-Avro, which the Surrey Flying Services are erecting, will be on its trial flights in the course of the next day or so.

The Marconi "Avro" was up during the week, and successful tests were made with the fixed "aerial" fitted to this machine. Representatives from the Air Ministry were "listening in" at the ground-station, and expressed themselves satisfied with the results obtained.

THE ROYAL AIR FORCE

London Gazette, February 14, 1922

General Duties Branch

Flying Offr. L. Darvall, M.C., is granted a permanent commn., retaining his present substantive rank and seny.; Nov. 17, 1921.

The following are granted permanent commns., retaining their present substantive rank and seny.; Oct. 24, 1919. The notifications in *Gazette*, Oct. 24, 1919, appointing them to short service commns., are cancelled.

Flight Lieut.—A. W. Fletcher, D.F.C., A.F.C.

Flying Offrs.—J. R. Cassidy, E. C. Usher.

Flying Offr. H. J. Saker is granted a permanent commn., retaining his present substantive rank and seny.; March 30, 1920. *Gazettes*, March 30, 1920, May 4, 1920, and June 8, 1920, concerning this officer are cancelled. Flight Lieut. A. L. Messenger, A.F.C., is placed on half-pay, Scale B; Feb. 11. The following Flying Offrs. relinquish their temp. commns. on return to Army duty:—C. V. A. Bucknall (Lieut., The Inniskillings); Jan. 25. B. Ancott (Lieut., R.G.A.); Jan. 31. Sqdn. Ldr. G. F. H. Faithfull, O.B.E., is placed on the retired list, and is granted the rank of Lieut.-Col.; Feb. 15.

Stores Branch

Flying Offr. H. G. McKechnie resigns his permanent commn.; Feb. 15.

Medical Service

T. L. P. Harries, M.B., is granted a short service commn. as a Flight Lieut., with effect from, and with seny. of, Jan. 30. The following are granted temp. commns. in the ranks stated, with effect from, and with seny. of, the dates indicated:—Flight Lieut. W. G. Weston, M.B.; Jan. 30. Flying Offr. T. A. G. Hudson, B.A.; Jan. 27. Capt. H. H. Mallet, Army Dental Corps, is granted a temp. commn. as a Flight Lieut. while attd. for duty with the R.A.F.; Jan. 20. He will continue to receive emoluments from Army funds.

Erratum

Gazette of Jan. 27.—For G. P. F. Hill, read G. P. F. Hills.

London Gazette, February 17, 1922

General Duties Branch

Gp. Capt. P. R. C. Groves, C.B., C.M.G., is placed on the retired list, and is granted the hon. rank of Brig.-Gen.; Feb. 3.

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the R.A.F. are notified:—

Air Vice-Marshal Sir E. L. Ellington, K.C.B., C.M.G., C.B.E., from Air Ministry to command Middle East Area on termination of appointment as Director-General of Supply and Research. 23.2.22.

Air Vice-Marshal Sir W. G. H. Salmond, K.C.M.G., C.B., D.S.O., from Middle East Area to Air Ministry, on appointment as Director-General of Supply and Research. 23.2.22.

Group Captain E. L. Gerrard, C.M.G., D.S.O., from R.A.F. Depôt (Inland Area) to command No. 1 Group Headquarters (Inland Area) *vice* Air-Commodore H. C. T. Dowding, C.M.G. 27.2.22.

Squadron Leader.—E. H. Sparling, A.F.C., from No. 5 Flying Training School (Inland Area) to Armament and Gunnery School (Cadre) (Inland Area). 18.2.22.

Flight Lieutenants.—A. McRitchie Moffatt, from Inspector of Recruiting (London) (Coastal Area) to Armament and Gunnery School (Cadre) (Inland Area). 18.2.22.

Royal Air Force Sports Board

Arrangements for March.—1st, R.A.F. *v.* R. Navy, Hockey, Uxbridge (2.45 p.m.); 2nd, R.A.F. *v.* Queen's Park Rangers, Association, Shepherds Bush (3.0 p.m.); 4th, R.A.F. (Cadet) College *v.* Queen's College, Cambridge, Athletics, Cranwell; 6th, R.A.F. *v.* Brentford, Association, Brentford (3.0 p.m.); 9th, R.A.F. *v.* Army, Golf, Sunningdale; 11th, R.A.F. *v.* Army, Rugby, Leyton (3.0 p.m.); 15th, R.A.F. Cross Country Championships, Athletics, Uxbridge (3.0 p.m.); 22nd to 24th, R.A.F. Spring Meeting, Golf, Porters Park; 23rd, R.A.F. *v.* Army, Association, Aylesbury (3.30 p.m.); 24th, R.A.F. *v.* Army, Fencing, Bertrand's Academy, London 2.30 p.m.); 27th, Inter-Services Cross Country Championships, Athletics, Uxbridge (3.0 p.m.); 31st, R.A.F. Cadet College *v.* R.M.A., Skill at Arms, Woolwich.

R.A.F. Nursing Service: Opportunities for Service Abroad

THE R.A.F. Nursing Service now offers opportunities for service abroad, and nurses wishing to join this service should therefore be willing, if required, to take their turn at service overseas, generally after a term of Home service.

Particulars regarding the particulars of service, regulations, etc., may be obtained on application to the Matron-in-Chief, Air Ministry, Kingsway, London, W.C. 2.

Definition and Nomenclature of Aircraft

THE following definitions will, the Air Ministry announce, be used officially from March 1:—

(1) Aeroplane.—Any aircraft heavier than air, with fixed wings, driven mechanically.

(2) Aeroplane is a generic term and includes:—

(i) Amphibians,
(ii) Seaplanes,
(iii) Landplanes,

denoting, respectively, aeroplanes designed to alight on or take off from—

(i) Land or water,
(ii) Water,
(iii) Land.

(3) Seaplanes include Float-Planes and Flying Boats, denoting, respectively, seaplanes fitted with floats or hull.

(4) Landplanes designed so as to facilitate their landing on a ship's deck will ordinarily be known as Ship Planes.

Three British Aviators Killed in Spain

AN unfortunate accident occurred at Cuatro Vientos (Madrid) Aerodrome, on Tuesday, February 14, resulting in the death of three British aviators, Messrs. R. Milne, F. J. Ortweiler and Richardson. No details of the accident are as yet to hand, but it seems that they were testing the machine—a Bristol—which had been acquired by public subscription for the Spanish Army, and crashed from only a short distance from the ground. Milne, who represented the Bristol Co., and Richardson, who was working for the Spanish Government, were given an impressive funeral at the British Cemetery, Cuatro Vientos, King Alfonso being represented, and many notable people also being present. The Spanish Army sent a Guard of Honour, and a squadron of aeroplanes circled over the cemetery during the service. Ortweiler's body is being brought back for burial in England. His sporting flying in the last Aerial Derby, and Oxford and Cambridge race will be remembered by most of our readers.

THE INTERNATIONAL AIRSHIP CONFERENCE

AN International Air Conference, recently announced in FLIGHT, was held at Australia House on February 14-17, with the object of considering the question of standardising certain airship fittings and other matters connected with the commercial airship.

The Members of the Conference were :—

British Empire		Mr. A. H. Ashbolt, Agent-General for Tasmania (Chairman).
		Maj. Scott, A.F.C., R.A.F.
France	..	Capt Sablé (Air Attaché).
		Lt. de Vaisseau Joughland.
Germany	..	Maj. Stelling (Parseval Airship Co.).
		Commander Herrera (Zeppelin Co.).
Italy ..	..	Maj. Graziani (Air Attaché).
Russia	..	Mr. Akasheff.
Spain	..	Commander Herrera (Manager, Spanish-Argentine Airship Co.).
U.S.A.	..	Maj. H. C. Greiger (Army).
		Commander Dyer (Navy).
		Mr. E. Wallington Butt (Commercial).

Hon. Secretary—Commander F. L. M. Boothby.

The official report states that, in addition to the countries represented by delegates, Japan, Switzerland and Czecho-Slovakia intimated their acceptance of the principle and ask to be supplied with a copy of the report.

1. In accordance with the recognition by several nations of the immediate possibility of airship communication, this conference was called and invitations issued by the Chairman to the countries immediately concerned in this method of communication. It is essential to record the fact that the meeting was a strictly private one of experts of different nationalities to consider and discuss matters of common interest in airship communications. Consequently we have met as a Committee with the following terms of reference :—

To Report—

(*a*) On the desirability or otherwise of standardising certain fittings in connection with airships for International communication.

(*b*) If the principle is accepted to then determine what fittings should be so standardised.

(*c*) On any other matter common to international airship Services.

2. The full Committee met at Australia House on February 14 ; on the 15th a Technical Sub-Committee sat ; on February 16 the Conference visited the British Government Air Station at Pulham, inspected mooring mast arrangements, sheds and airships, and on February 17 the full Committee again met and adopted final resolutions.

3. The Committee is unanimously of opinion that the resolutions so adopted should be accepted by the nationalities concerned, and that all airships and airship stations built for international purposes should make provision for the recommendations contained in the resolutions given below :—

(1) That the principle of standardisation is accepted.

(2) That standardisation means such an arrangement as permits the airships of one nation to use the landing, mooring, gassing and refuelling arrangements of any other nation.

(3) That each country retains for itself the right to receive airships by either or all of the following methods :—

(*a*) At air sheds ; (*b*) by mooring on the ground ; (*c*) on water ; (*d*) by three-wire mooring arrangements ; (*e*) by mooring mast.

(4) That when airships are landing at shed, on the ground or on the water, that all trail ropes, pulley blocks used in connection therewith, and handling guys, be standardised.

(5) That any countries adopting the principle of mooring to masts, shall provide that such masts and ships be provided with standardised couplings, water, petrol and gas connections.

(6) That this Committee recommends to the next International Air Conference the formation of a Committee to determine the airworthiness of airships. It is recognised that the conditions of airship travel vary according to route and season of the year, consequently the impossibility of laying down a definite margin of fuel and ballast to be carried. The situation can best be met by the formation of a small permanent Committee to determine margins for each route according to its merits.

(7) That each country be asked to create an official register of airships in which will be listed all airships and air stations, indicating such airships and air stations as comply with the "International Standards" hereinafter arranged.

(8) That pending the decision of the Commission Internationale de Navigation Aérienne it is resolved that the Council of the Royal Aeronautical Society of London be asked to permit their Secretary to receive correspondence referring to "International Standards" and if desirable to authorise him to convene a further conference. In such event invitations will be forwarded to the countries interested through the Air Attachés of the Embassies in London.

(9) That Lloyd's and Insurance Companies in different countries be informed of the resolutions and standards adopted by the Conference with a suggestion that such standards be adopted by Lloyd's and Insurance Companies as the basis upon which minimum rates of insurance will be fixed.

Standards

(10) That the metric system of measurement be adopted.

(11) That all rigid, semi-rigid and non-rigid airships over 15,000 cubic metre capacity be required to carry :—

(*a*) A trail rope of not less than half the length of the ship, with a minimum of 100 metres.

(*b*) The forward side guy ropes to be of such a length as to reach not less than 40 metres below the lowest point of the airship.

(*c*) Eyes to which other guy ropes can be secured.

(*d*) Some method for hauling down the stern.

(12) Air stations are required to provide :—

(*a*) A landing block capable of taking the largest trail ropes carried by any airship.

(*b*) Side guys and toggles suitable for airships of any size.

(13) All gas, fuel, water and oil coupling pipes shall be fitted with "International" right-handed threads.

(14) In addition to facilities provided in sheds for refuelling airships similar facilities should also be available on the landing grounds.

(15) This Conference recommends the following sizes as most suitable for the flexible connection between airships and mooring masts or air station :—

Gas connection (inside measurement)	..	300 mm.
Water ,, ,, ,,	..	75 ,,
Fuel ,, ,, ,,	..	40 ,,

Airships containing pipes of dimensions other than those indicated, to have such arrangements installed as will enable their pipes to connect up with the standards recommended herein.

(16) All stations are to be fitted with female connections ; airships with male connections.

(17) Airships designed for mooring to mast must carry a cone gimballed on to the ship and rotating on its own axis. The size and shape of such cone to be that shown on the attached drawing. (Drawings are being prepared and will, it is hoped, be published in FLIGHT.—ED.) The wires passing through such cone shall not exceed a diameter of 18 mm. Such landing wire must be fitted at the outboard and with a splice, the eye of which shall be 230 mm. long. Also as shown on the drawing.

(18) The mooring mast station must provide a similar rope fitted with a quick coupling to take a loop at the outboard end of the trailing rope. The mast to be fitted to take the rope (up to 18 mm. diameter) together with the necessary coupling.

(19) Suggested signals for mast mooring :—

At Stations.	At Day.	At Night and in Fog.
The position of the mast mooring wire will be indicated by	A White Patch	By a White Light waved.
When the mooring wire ropes have been secured the ground will signal airship	By waving a White Flag	By a White Light flashed.
When the airship is ready to haul down the ship will so indicate	By a Green Flag	By a Green Light
To stop hauling the ship will indicate	By a Red Flag	By a Red Light.
To ease away the ship will indicate	By Red and Green Flags shown together	By Red and Green Lights shown together.

(20) That the standards arrived at remain in force for two years, when the whole question can be considered in the light of further experience then gained. If at any time any important development occurs or fresh inventions, or if by practical experience standards adopted are found dangerous, the Committee will immediately be convened to establish fresh standards.

At the conclusion of the conference a hearty vote of thanks was passed to Sir Joseph Cook, the High Commissioner for Australia, in granting the use of the rooms for the conference.

IN PARLIAMENT

Imperial Airship Service

SIR J. D. REES, on February 14, asked the Secretary of State for India whether he can give the House any information regarding the proposed Imperial airship service in so far as it affects India; and whether the Government of India has taken or proposes to take any part in the suggested England, Egypt, India, and Australia service?

Mr. Montagu: I have been informed by the Government of India that they regret that the present financial position precludes them from making any contribution to the establishment of the experimental Imperial airship service which has been proposed.

Royal Air Force and the Stores Branch

MR. RAPER, on February 14, asked the Secretary of State for Air how many men are employed in the accountant's section of the Stores Branch, Royal Air Force; how many of this total quantity have been pilots and/or observers; how many are non-service men; and whether it would have been possible to have filled all vacancies in this section with ex-pilots and/or ex-observers?

Captain Guest: It is assumed that the question refers to officers granted commissions in the Stores Branch of the Royal Air Force for accountant duties; the men employed in this work are ordinary enlisted clerks of the Royal Air Force. On this assumption, the answer to the first question asked is 99 officers, to the second 10 officers, and to the third none. With regard to the last question, it was not considered desirable, in view of the need for obtaining officers with the best accountant experience in the interests of economy and efficiency, to restrict entry to ex-pilots and ex-observers, to the exclusion of other candidates from the three Services who possessed the necessary qualifications.

R.A.F. Aeroplanes and Engines

MR. RAPER, on February 15, asked the Secretary of State for Air what types of aeroplanes and engines are at present in use in the Royal Air Force, and how many of these types were designed before or during 1918?

Capt. Guest: As the answer is rather long I will, with my hon. friend's permission, circulate the information in the "Official Report."

The following is the answer:—

The following are the types of aeroplanes and engines at present in use in the Royal Air Force. With the exception of the "Vickers Vernon" "Vickers Ambulance," "Fairey 3.D. Seaplane," and "Westland Walrus" machines, all the above aeroplanes and engines were designed before or during 1918.

Aeroplanes.—Avro 504.K, Snipe, Bristol Fighter, D.H.9.A, D.H.10, Vickers Vimy, Vickers Vernon, Vickers Ambulance, F.2.A Flying Boat, F.5 Flying Boat, Fairey 3.D Seaplane, Westland Walrus, Sopwith Cuckoo, Panther, Ships Camel, Nieuport Nighthawk, Sopwith Salamander.

Engines.—B.R.II, B.R.I, Hispano-Suiza (Viper 1), Liberty, Mono, Napier Lion (II), Rolls Royce (Falcon 3), Rolls Royce (Eagle 8).

Irish Free State Air Force

COL. GRETTON, on February 16, asked the Prime Minister whether under the terms of the Treaty the Irish Free State will be able to establish and maintain its own Air Force?

Mr. Churchill: Yes, Sir. I understand that the term "military defence force" in Article 10 of the Articles of Agreement includes an Air Force.

Col. Gretton: Has the Government had any recommendation made to them on this point?

Mr. Churchill: The naval and military clauses were carefully considered with the experts of those various Departments, and the Ministers concerned in dealing with them are the Ministers usually associated with the work of the Committee of Imperial Defence. The same is true of the arrangement made about the Air Force. It was not considered of sufficient importance to insist upon any specific stipulation in that case, and I think very sensibly so.

Mr. G. Terrell: Were these arrangements actually approved of by the technical authorities?

Mr. Churchill: It is not a fair thing to try and cite technical authorities, military or naval, as approving of matters which are wholly political and surrounded by controversy.

Capt. W. Benn: Hear, hear!

Mr. Churchill: I am very pleased to have that approval from a wholly unexpected and unsolicited quarter.

R.A.F. Deserters

LIEUT.-COM. KENWORTHY asked the Prime Minister whether men who were absentees or deserters from the Royal Flying Corps prior to the establishment of the Air Ministry are now liable to punishment; and, seeing that there is a conflict of opinion between the War Office and the Air Ministry as to the authority having jurisdiction and the action to be taken in such cases, if he is prepared to authorise a general amnesty?

Mr. Chamberlain: Deserters from the Royal Flying Corps prior to the establishment of the Air Ministry are still liable to punishment under the Army Act for their offence, and under the Air Force Act for their desertion from the Royal Air Force after the establishment of the Air Ministry. There is no conflict of opinion between the War Office and the Air Ministry as to the authority having jurisdiction and action in such cases. The answer to the last part of the question is in the negative.

* * * *

SIDE-WINDS

IT is worthy of note in connection with the statement from the Chinese Charge d Affaires, read by Lord Weir, at the Air Conference, commenting on the reliability of the Vickers machines employed on the air mail service in China, that Smith's Speed and Distance Recording instruments shared in demonstrating the reliability of British-made goods.

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AN interesting display of the E. R. Calthrop's Aerial Patents is on view until further notice at one of Messrs. Selfridge's showrooms. Photographs taken with a cinema camera serve to show very clearly every phase of a Guardian Angel Parachute descent. These, in conjunction with complete parachutes and components, form an excellent means of instructing the general public in matters "parachutic," whilst for the purpose of training the young idea, model parachutes are on sale at reasonable prices.

"Exide's" New London Depôt

LAST week the Chloride Electrical Storage Co., Ltd., opened their new London showrooms and Service Station at 219–229 Shaftesbury Avenue, just off Oxford Street. There was a little house-warming function at which the guests were shown over the various departments, saw the large stocks of complete batteries and spare parts in the stores, had the different types of batteries shown to them, and saw the way in which users of Exide batteries are rendered real and efficient service.

"Exide Battery Service" was the text of a short address by Mr. D. P. Dunne, Director and Sales Manager, at the subsequent luncheon at the Holborn Restaurant. He said the new depôt had been opened to promptly satisfy the requirements of customers in the South of England and in the Midlands who desire new batteries or require batteries repaired, and from there they could supply their service agents in that area with all the materials or parts they require. He said that a shop for the sale of storage batteries on these lines was a novelty. Its success was not problematical; they knew that successful results were bound to follow upon battery service such as they could offer.

Everybody is free to use the Exide service organisation, whatever make of battery he may use. There was no membership card or card of admission, and their prices were fixed so that anybody using an Exide service depôt could get to know beforehand what the charges were, and they were the same from John o' Groat's to Land's End.

Mr. Dunne concluded by referring to some of the successful work done by Exide batteries during the War on aeroplanes, airships, tractors, electric cars, armoured cars, submarines, etc., and also detailed some other uses such as lighting of farms, miners' lamps, etc., and said it was Exide with its special and completely non-spillable container which had obtained an award from the Royal Commission on Awards to Inventors.

By way of a final word Mr. Dunne invited anyone seeking information regarding batteries to apply to the new depôt at 219, Shaftesbury Avenue, or to Clifton Junction, or to any "Exide" station, and thus sample one side of "Exide" service.

Further Tests with Aveline Stabiliser

THE MESSAGERIES AÉRIENNES are continuing their experiments with the Aveline stabiliser (a description of which appeared in FLIGHT of Feb. 3, 1921). The firm is, we understand from Messrs. Auto Controls, Ltd., of 19, Regent Street, British Concessionaires of the apparatus, doing these tests free of charge, and the results obtained so far have been very encouraging. In a letter to the French *Section Technique*, the results are described, from which we quote the following: "On the 14th inst., new tests were made above Le Bourget; several of the Company's pilots were on board. The sky was overcast. The Goliath flew through the fog and emerged into clear air at 1,500 metres altitude, effecting the climb without difficulty and without intervention from the pilot. At 1,500 metres several turns were made, both left-hand and right-hand. The engines were then throttled down and the machine descended to within 50 metres from the ground, without the intervention of the pilot. During the descent the engines were several times opened up and throttled down, the machine automatically climbing when the engines were opened out and gliding when they were throttled down. Three times during the flight the pilots were changed, the machine flying entirely without pilot during these changes." The report further states that the Company is convinced that, in its present form, the stabiliser is capable of great services in traversing large banks of fog, and in taking off from aerodromes covered in fog.

FLIGHT

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